CHRONOLOGY OF SELECTED HIGHLIGHTS IN AMERICAN HUMAN SPACEFLIGHTS, 1961-1995

May 5, 1961 — *Freedom 7*, the first piloted Mercury spacecraft (No. 7) carrying Astronaut Alan B. Shepard, Jr., was launched from Cape Canaveral by Mercury-Redstone (MR-3) launch vehicle, to an altitude of 115 nautical miles and a range of 302 miles. It was the first American space flight involving human beings. Shepard demonstrated that individuals can control a vehicle during weightlessness and high G stresses, and significant scientific biomedical data were acquired. He reached a speed of 5,100 miles per hour and his flight lasted 14.8 minutes.

Feb. 20, 1962 — John Glenn became the first American to circle the Earth, making three orbits in his *Friendship 7* Mercury spacecraft. Despite some problems with spacecraft—Glenn flew parts of the last two orbits manually because of an autopilot failure and left his normally jettisoned retrorocket pack attached to his capsule during reentry because of a loose heat shield—this flight was enormously successful. The public, more than celebrating the technological success, embraced Glenn as a personification of heroism and dignity. Among other engagements, Glenn addressed a joint session of Congress and participated in several ticker-tape parades around the country.

May 15-16, 1963 — The capstone of Project Mercury, the flight of *Faith 7*, took place on this date with the flight of astronaut L. Gordon Cooper, who circled the Earth 22 times in 34 hours.

Mar. 23, 1965 — Following two unoccupied test flights, the first operational mission of Project Gemini took place on March 23, 1965. Mercury astronaut Gus Grissom commanded the mission, with John W. Young, a Naval aviator chosen as an astronaut in 1962, accompanying him.

Jun. 3-7, 1965 — The second piloted Gemini mission, GT-4, stayed aloft for four days and astronaut Edward H. White II performed the first extra-vehicular activity (EVA) or spacewalk by an American.

Oct. 11-22, 1968 — The first piloted flight of the Apollo spacecraft, Apollo 7, and Saturn IB launch vehicle, this flight involved astronauts Walter M. Schirra, Jr., Donn F. Eisele, and Walter Cunningham who tested hardware in Earth orbit.

Dec. 21-27, 1968 — On December 21, 1968, Apollo 8 took off atop a Saturn V booster from the Kennedy Space Center with three astronauts aboard—Frank Borman, James A. Lovell, Jr., and William A. Anders—for a historic mission to orbit the Moon. At first it was planned as a mission to test Apollo hardware in the relatively safe confines of low Earth orbit, but senior engineer George M. Low of the Manned Spacecraft Center at Houston, Texas (renamed the Johnson Space Center in 1973), and Samuel C. Phillips, Apollo Program Manager at NASA headquarters, pressed for approval to make it a circumlunar flight. The advantages of this could be important, both in technical and scientific knowledge gained as well as in a public demonstration of what the U.S. could achieve. In the

summer of 1968 Low broached the idea to Phillips, who then carried it to the administrator, and in November the agency reconfigured the mission for a lunar trip. After Apollo 8 made one and a half Earth orbits its third stage began a burn to put the spacecraft on a lunar trajectory. As it traveled outward the crew focused a portable television camera on Earth and for the first time humanity saw its home from afar, a tiny, lovely, and fragile "blue marble" hanging in the blackness of space. When it arrived at the Moon on Christmas Eve this image of Earth was even more strongly reinforced when the crew sent images of the planet back while reading the first part of the Bible—"God created the heavens and the Earth, and the Earth was without form and void"—before sending Christmas greetings to humanity. The next day they fired the boosters for a return flight and "splashed down" in the Pacific Ocean on December 27. It was an enormously significant accomplishment coming at a time when American society was in crisis over Vietnam, race relations, urban problems, and a host of other difficulties. And if only for a few moments the nation united as one to focus on this epochal event. Two more Apollo missions occurred before the climax of the program, but they did little more than confirm that the time had come for a lunar landing.

Jul. 16-24, 1969 The first lunar landing mission, Apollo 11 lifted off on July 16, 1969, and after confirming that the hardware was working well began the three day trip to the Moon. At 4:18 p.m. EST on July 20, 1969, the Lunar Module—with astronauts Neil A. Armstrong and Edwin E. Aldrin—landed on the lunar surface while Michael Collins orbited overhead in the Apollo command module. After checkout, Armstrong set foot on the surface, telling the millions of listeners that it was "one small step for a man—one giant leap for mankind." Aldrin soon followed him out and the two plodded around the landing site in the 1/6 lunar gravity, planted an American flag but omitted claiming the land for the U.S. as had routinely been done during European exploration of the Americas, collected soil and rock samples, and set up some experiments. The next day they launched back to the Apollo capsule orbiting overhead and began the return trip to Earth, "splashing down" in the Pacific on July 24.

Apr. 11-17, 1970 The flight of Apollo 13 was one of the near disasters of the Apollo flight program. At 56 hours into the flight, an oxygen tank in the Apollo service module ruptured and damaged several of the power, electrical, and life support systems. People throughout the world watched and waited and hoped as NASA personnel on the ground and the crew, well on their way to the Moon and with no way of returning until they went around it, worked together to find a way safely home. While NASA engineers quickly determined that sufficient air, water, and electricity did not exist in the Apollo capsule to sustain the three astronauts until they could return to Earth, they found that the Lunar Module—a self-contained spacecraft unaffected by the accident—could be used as a "lifeboat" to provide austere life support for the return trip. It was a close-run thing, but the crew returned safely on April 17, 1970. The near disaster served several important purposes for the civil space program—especially prompting reconsideration of the propriety of the whole effort while also solidifying in the popular mind NASA's technological genius.

Jul. 26-Aug. 7, 1971 The first of the longer, expedition-style lunar landing missions, Apollo 15 was the first to include the lunar rover to extend the range of the astronauts on the Moon. They brought back one of the prize artifacts of the Apollo program, a sample of ancient lunar crust called the "Genesis Rock."

Dec. 7-19, 1972 Apollo 17 was the last of the Apollo missions to the Moon, and the only one to include a scientist—astronaut/geologist Harrison Schmitt—as a member of the crew.

May 25-Jun. 22, 1973 Following the launch of the orbital workshop, Skylab, on May 14, 1973, the Skylab 2 mission began. The workshop had developed technical problems due to vibrations during lift-off and the meteoroid shield—designed also to shade Skylab's workshop from the Sun's rays—ripped off, taking with it one of the spacecraft's two solar panels, and another piece wrapped around the other panel keeping it from properly deploying. In spite of this, the space station achieved a near-circular orbit at the desired altitude of 270 miles. While NASA technicians worked on a solution to the problem, an intensive ten-day period followed before the Skylab 2 crew launched to repair the workshop. After substantial repairs requiring extravehicular activity (EVA), including deployment of a parasol sunshade that cooled the inside temperatures to 75 degrees Fahrenheit, by June 4 the workshop was in full operation. In orbit the crew conducted solar astronomy and Earth resources experiments, medical studies, and five student experiments. This crew made 404 orbits, in the process making three EVAs totaling six hours and 20 minutes. The first group of astronauts returned to Earth on June 22, 1973, and two other Skylab missions followed.

Jul. 15-24, 1975 The Apollo-Soyuz Test Project was the first international human space flight, taking place at the height of the détente between the United States and the Soviet Union during the mid-1970s. It was specifically designed to test the compatibility of rendezvous and docking systems for American and Soviet spacecraft, and to open the way for international space rescue as well as future joint missions. To carry out this mission existing American Apollo and Soviet Soyuz spacecraft were used. The Apollo spacecraft was nearly identical to the one that orbited the Moon and later carried astronauts to Skylab, while the Soyuz craft was the primary Soviet vehicle used for cosmonaut flight since its introduction in 1967. A universal docking module was designed and constructed by NASA to serve as an airlock and transfer corridor between the two craft. Astronauts Thomas P. Stafford, Vance D. Brand, and Donald K. Slayton took off from Kennedy Space Center on July 15, to meet the already orbiting Soyuz spacecraft. Some 45 hours later the two craft rendezvoused and docked, and then Apollo and Soyuz crews conducted a variety of experiments over a two-day period. After separation, the Apollo vehicle remained in space an additional six days while Soyuz returned to Earth approximately 43 hours after separation. The flight was more a symbol of the lessening of tensions between the two superpowers than a significant scientific endeavor, a sharp contrast with the competition for international prestige that had fueled much of the space activities of both nations since the late 1950s.

Apr. 12, 1981 Astronauts John W. Young and Robert L. Crippen flew Space Shuttle *Columbia* on the first flight of the Space Transportation System (STS-1). *Columbia*, which takes its name from three famous vessels including one of the first U.S. Navy ships to circumnavigate the globe, became the first airplane-like craft to land from orbit for reuse when it touched down at Edwards Air Force Base in southern California at approximately 10:21 a.m. Pacific Standard Time on April 14th after a flight of two days, six hours and almost 21 minutes. The mission also was the first to employ both liquid- and solid-propellant rocket engines for the launch of a spacecraft carrying humans.

Jun. 18, 1983 Astronauts Robert L. Crippen and Frederick H. Hauck piloted Space Shuttle *Challenger* (STS-7) on a mission to launch two communications satellites and the reusable Shuttle Pallet Satellite (SPAS 01). Sally K. Ride, one of three mission specialists on the first Shuttle flight with five crewmembers, became the first American woman astronaut. *Challenger* was named after the H.M.S. *Challenger*, an English research vessel operating from 1872 to 1876.

Aug. 30, 1983 Astronauts Richard H. Truly and Daniel C. Brandenstein piloted Space Shuttle *Challenger* (STS-8) on another historic mission, carrying the first black American astronaut, Guion S. Bluford, into space as a mission specialist. The astronauts launched communications satellite Insat 1B into orbit.

Nov. 28, 1983 Astronauts John W. Young and Brewster W. Shaw piloted Space Shuttle *Columbia* (STS-9) on a mission that carried the first non-U.S. astronaut to fly in the U.S. space program, West German Ulf Merbold. *Columbia* also transported Spacelab 1, the first flight of this laboratory in space, carrying more than 70 experiments in 5 areas of scientific research: astronomy and solar physics, space plasma physics, atmospheric physics and Earth observations, life sciences, and materials science.

Jan. 28, 1986 The Space Shuttle *Challenger*, STS-51L, was tragically destroyed and its crew of seven was killed, during its launch from the Kennedy Space Center about 11:40 a.m. The explosion occurred 73 seconds into the flight as a result of a leak in one of two Solid Rocket Boosters that ignited the main liquid fuel tank. The crewmembers of the *Challenger* represented a cross-section of the American population in terms of race, gender, geography, background, and religion. The explosion became one of the most significant events of the 1980s, as billions around the world saw the accident on television and empathized with any one of the several crewmembers killed. The disaster prompted a thorough review of the shuttle program and NASA overall, leading to substantive reforms in the management structure, safety program, and procedures of human spaceflight.

Apr. 24-29, 1990 During the flight of the Space Shuttle *Discovery* (STS-31) the crew deployed the Hubble Space Telescope. Soon after deployment, controllers found that the telescope was flawed by a "spherical aberration," a mirror defect only 1/25th the width of a human hair, that prevented Hubble from focusing all light to a single point. At first many believed that the spherical aberration would cripple the 43-foot-long telescope, and NASA received considerable negative publicity, but soon scientists found a way with computer enhancement to work around the abnormality and engineers planned a servicing mission to fully correct it with an additional instrument. Even with the aberration, Hubble made many important astronomical discoveries, including striking images of galaxy M87, providing evidence of a potentially massive black hole.

Dec. 2-12, 1993 Astronauts Richard O. Covey and Kenneth D. Bowersox piloted Space Shuttle *Endeavour* (STS-61) on a highly successful mission to service the optics of the Hubble Space Telescope (HST) and perform routine maintenance on the orbiting observatory. Following a precise and flawless rendezvous, grapple, and berthing of the telescope in the cargo bay of the Shuttle, the *Endeavour* flight crew, in concert with controllers at Johnson Space Center, Houston, Texas, and Goddard Space Flight Center, Greenbelt, Maryland, completed all eleven planned servicing tasks during five extravehicular activities for full accomplishment of all STS-61 servicing objectives. This included installation of a new Wide Field & Planetary Camera and sets of corrective optics for all the other instruments, as well as replacement of faulty solar arrays, gyroscopes, magnetometers, and electrical components to restore the reliability of the observatory subsystem. *Endeavour* then provided HST with a reboost into a 321-nautical-mile, nearly circular orbit. Re-deployment of a healthy HST back into orbit using the shuttle robotic arm occurred at 5:26 a.m. EST on December 10th, and the telescope was once again a fully operational, free-flying spacecraft with vastly improved optics. Orbital verification of HST's improved capabilities occurred in early Jan., well ahead of the March schedule.

Endeavour, the newest of the orbiters, was named after the eighteenth century vessel captained by British explorer Capt. James Cook. The new Shuttle craft took its maiden voyage in May 1992.

Feb. 3-11, 1994 Astronauts Charles F. Bolden and Kenneth S. Reightler, Jr., flew Space Shuttle *Discovery* (STS-60) on a historic mission featuring the first Russian cosmonaut to fly on a U.S. mission in space, Mission Specialist Sergei K. Krikalev, veteran of two lengthy stays aboard the Russian *Mir* Space Station. This mission underlined the newly inaugurated cooperation in space between Russia and the U.S., featuring Russia's becoming an international partner in the international space station effort involving the U.S. and its international partners.

Feb. 3-11, 1995 Exactly one year after a major cooperative flight with the Russians in STS-60, NASA's Space Shuttle *Discovery*, this time STS-63, flew another historic mission featuring the flyby of the Russian *Mir* Space Station. It also featured the first time that a woman pilot, Eileen M. Collins, flew the Space Shuttle.

Mar. 16-Jul. 7, 1995 One of the most significant missions to take place in recent years occurred in 1995 when American astronaut Norman E. Thagard, M.D., spent more than three months in order on the Russian space station *Mir*. Dr. Thagard went aboard *Mir* on March 16, 1995, and returned to Earth aboard the Space Shuttle *Atlantis* at the conclusion of STS-71, the first shuttle/*Mir* docking mission. Thagard's flight set a record for length o time in space by a U.S. astronaut. He broke the *Skylab 4* crew record of 84 days set in 1973. He and the two Russian members of the *Mir 18* crew, Vladimir Dezhurov and Gennadiy Strekalov, were the first *Mir* crew to return to Earth via the Space Shuttle.

Jun. 27-Jul. 7, 1995 STS-71, the Space Shuttle *Atlantis*, undertook a mission to dock with the Russian space station, *Mir*. This mission was the first of seven planned shuttle/*Mir* link-ups between 1995 and 1997, including rendezvous, docking, and crew transfers. These flights will pave the way toward assembly of an international space station which will be constructed in orbit beginning in November 1997. When *Atlantis* docked with *Mir* on 29 July, it was perhaps the most significant event in the history of spaceflight since the symbolic joining of Apollo and Soyuz spacecraft twenty years earlier. It signalled a new age of cooperation in space, where exploration of the universe would be measured more in terms of what a coalition of states had accomplished rather than what a single nation had done. After the ceremonies following the rendezvous and docking, the two groups of spacefarers undertook several days of joint scientific investigations inside the *Spacelab* module tucked in *Atlantis's* large cargo bay. Once the data are to provide more understanding of the human body and the microgravity environment. Research in seven different medical and scientific disciplines, begun earlier on the *Mir* also concluded on STS-71. At the end of joint docked activities on Jul. 4, 1995, Russian cosmonauts Anatoly Y. Solovyev and Nikolai M. Budarin assumed responsibility for operations of the *Mir* station.

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